

2014 UDOT RESEARCH PROBLEM STATEMENT

*** Problem statement deadline is April 16, 2014. Submit statements to Russ Scovil at rgscovil@utah.gov ***

Title: Statistical Analysis and Sampling Standards for Maintenance Management Quality Assurance (MMQA) **No. :** 14.02.10

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UDOT Champion (suggested): Tim Ularich/Shana Lindsey

Select a Subject Area

☐ Materials/Pavements

☒ Maintenance

☐ Traffic Mgmt/Safety

☐ Preconstruction

☐ Planning

☐ Structures/Geotechnical

1. Describe the problem to be addressed.

Maintenance management is very critical to the efficient allocation of resources and greater efficiencies in work processes. State DOTs need to continuously plan maintenance activities to monitor and maintain their highways, bridges, and other transportation infrastructures. Considering the limited budget and resources, maintenance activities need to be carefully planned and deployed such that the field inspections for measured conditions are conducted appropriately and statistically representative. It is thus necessary to develop a standardized statistical method to determine the samples (frequency and amount) to be collected to streamline productivity and ensure maintenance quality. This project will also develop a methodological framework for compiling, processing and statistically analyzing the data from sampled field inspections. Resampling statistical method might be used here in case the collected data are not significantly representing the “true” measurement. The framework will be able to determine the overall conditions of the system based on the collected sample data.

2. Explain why this research is important.

It is critical to streamline the process of sampling field inspection sites through developing a statistical framework. An effective sampling method ensures that the items chosen to be measured from the entire “population” is statistically represented. Instead of inspecting all the sites available, the sampling method can identify a limited number of sites for inspection yet accurately represent the conditions of the overall system. The proposed statistical method would be effective to achieve the satisfying accuracy with significantly less resource and funding.

Upon the collection of measured items, it is of great importance to report the finding in a manner that all maintenance levels are fully aware of the quality of maintenance of the areas that are pertinent to them. The proposed methodological framework will achieve this by generating a transferable analytical procedure to determine the overall conditions of the system, which provides references for senior leaders to prioritize the maintenance activities.

3. List the research objective(s):

1. Develop sampling standards for the maintenance management to effectively measure roadway conditions.
2. Develop methodological framework to analyze the measured samples in order to obtain the overall system conditions. Resampling method might be developed as well in case that the sampled measurement is insufficient to represent the overall population.

4. List the major tasks:

1. Review literature and practice regarding maintenance management and quality assurance.
2. Meet with the project TAC to identify the important maintenance features and elements, and the features’ inventory. Determine the overall distribution of measured features.
3. Develop a detailed work plan for developing statistical analysis and sampling method for the maintenance management.
4. Upon approval from the project TAC, execute the work plan, including:
 - a. Develop sampling method based on the overall distribution of measurement. To obtain a greater degree of representation, the total inventory will be divided into homogenous subsets or strata based on classification that is deemed important to the maintenance team (e.g. facility type, geography, etc.)
 - b. Determine sample size and conduct field inspection for the identified measurement.
 - c. Statistically analyze the sampled measurements and develop methodological framework to determine the overall

conditions of the system

5. Document the entire research effort in a final research report. The Task 5 activities will follow the most current edition of UDOT Research Division's Final Report Process.

5. List the expected results:

1. A sampling method that will assist with Maintenance Management Quality Assurance (MMQA) to determine the frequency and number of sites for measuring conditions.
2. A methodological framework for analyzing the collected sample and determine the overall system conditions for examination by all levels of maintenance.

6. Describe how this research will be implemented.

This research will provide a systematical approach for the MMQA section to effectively plan the maintenance activities. The methodological framework developed can serve as a guidance for the application of the maintenance quality assurance program. It will be of great interests to maintenance engineers and managers to help streamline the work process and improve efficiency.

7. Requested from UDOT: \$30K

Other/Matching Funds: \$20K

Total Cost: \$50K

8. Outline the proposed schedule, including start and major event dates.

The following schedule is proposed to give a general idea of the relative timing of the major event dates. The University of Utah will work with the research manager, project champion, and TAC to finalize the scope and schedule.

- a) Proposed Start Date: September 1, 2014
- b) Task 2 TAC Meeting: December 31, 2014
- c) Submit Task 3 Detailed Work Plan: February 28, 2015
- d) Draft Final Report: October 30, 2015
- e) Final Report: December 31, 2015